



Class: X	Department: SCIENCE 2021 - 22	Date of completion: -27.01.22
HANDOUTS	CHAPTER: CARBON AND ITS COMPOUNDS	Note: A4 FILE FORMAT
Name of the student:	Class & Sec:	Roll No:

CHAPTER-4-CARBON AND ITS COMPOUNDS

- Carbon is found in the atmosphere, inside the earth's crust and in all living organisms.
- Carbon is present in fuels like wood, coal, charcoal, petroleum, coke, natural gas, biogas etc.
- Carbon is present in compounds like carbonates and hydrogen carbonates.
- Carbon is found in free state as diamond, graphite and fullerenes.
- Earth's crust contains 0.02% of carbon as minerals
- Atmosphere has 0.03% of carbon dioxide gas.

CARBON (NON-METAL)

Atomic no.- 6

Electronic configuration– K L

2 4

4 electrons in the outer shell and needs to gain or lose 4 electrons to attain stability.

- Carbon cannot gain 4 electrons. The nucleus with 6 protons cannot hold 10 electrons. so it cannot form C^{4-}
- Carbon cannot lose 4 electrons. large amount of energy is required to remove 4 electrons. So, it cannot form C^{4+}
- Carbon can share its valence electrons with other carbon atoms or with atoms of other elements.

COVALENT BOND

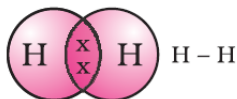
- The bond which is formed by the sharing of electrons is known as covalent bond.
- The compounds which are formed by the sharing of electrons are called covalent compounds.

Examples for simple covalent molecules

1. H₂

Atomic number-1, Electronic configuration- K

1



It requires one more electron to fill the K shell. So, sharing of one pair of electrons.

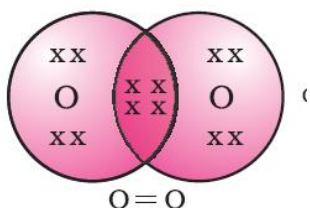
The covalent bond which is formed by the sharing of one pair of electrons is known as a **single bond(-)**

2. Oxygen molecule

Atomic no- 8, K L

2 6

Two more electrons are required (sharing of two pairs of electrons)



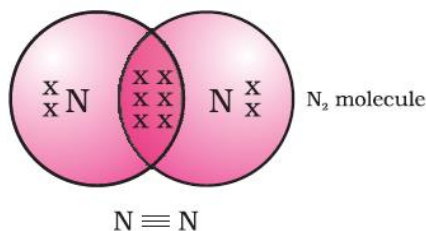
Double bond- The covalent bond which is formed by the sharing of two pairs of electrons.

3. Nitrogen molecule

Atomic no-7, K L

2 5

Three more electrons are required (sharing of 3 pairs of electrons)



Triple bond- The covalent bond which is formed by the sharing of 3 pairs of electrons.

Properties of covalent compounds

1. They have strong bonds within the molecule. But intermolecular forces are weak.
2. Low melting and boiling points.

- Generally poor conductors of electricity.

Versatile nature of carbon (Reason for the formation of large number of carbon compounds)

The two properties of carbon element which leads to the formation of large number of carbon compounds are: -

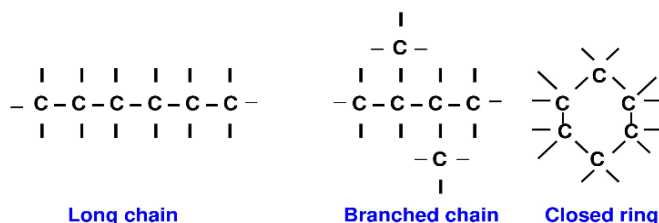
- Catenation and
- Tetravalency

1. **Catenation** (self-linking)

The property of carbon element due to which its atoms can join with one another to form long carbon chains is called catenation.

Three types of chains can be formed:

- Straight chains (long chains)
- Branched chains
- Rings



The carbon – carbon bond is very strong and stable. (This gives large number of compounds)

Silicon also exhibits catenation. Only up to 7/8 atoms join together to form compounds. These silicon compounds are unstable and very reactive.

Tetravalency

Due to its large valency of 4, carbon can form covalent bonds with other four carbon atoms or atoms of other elements like Hydrogen, Oxygen, Nitrogen, Sulphur, Chlorine and many more atoms.



- Because of small size, carbon can form strong bonds with other atoms and these compounds are stable.

HYDROCARBONS

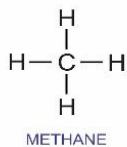
A compound made up of carbon and hydrogen only is called a hydrocarbon.

The most important natural source of hydrocarbons is petroleum or crude oil.

- Two types of hydrocarbons— saturated and unsaturated.

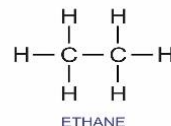
Saturated hydrocarbons (Alkanes)

A hydrocarbon in which the carbon atoms are connected by only single bonds is called a saturated hydrocarbon.



Eg:- methane CH₄,

Ethane C₂H₆



Unsaturated hydrocarbons

A hydrocarbon in which two carbon atoms are joined by a double bond or triple bond. These are of two types--- **Alkenes and Alkynes**

Alkenes- An unsaturated hydrocarbon in which 2 carbon atoms are connected by a double bond.

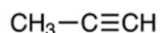
Eg:- Ethene (CH₂= CH₂),
Propene (CH₃-CH=CH₂)

Alkynes-

An unsaturated hydrocarbon in which 2 carbon atoms are connected by a triple bond.



Ethyne C₂H₂

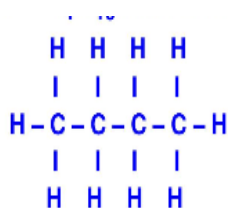


Propyne C₃H₄

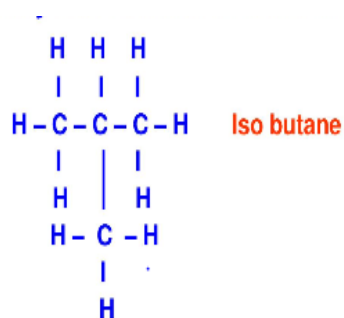
ISOMERS

Organic compounds having the same molecular formula and different structures are known as isomers. Isomerism is possible with hydrocarbons having 4 or more carbon atoms.

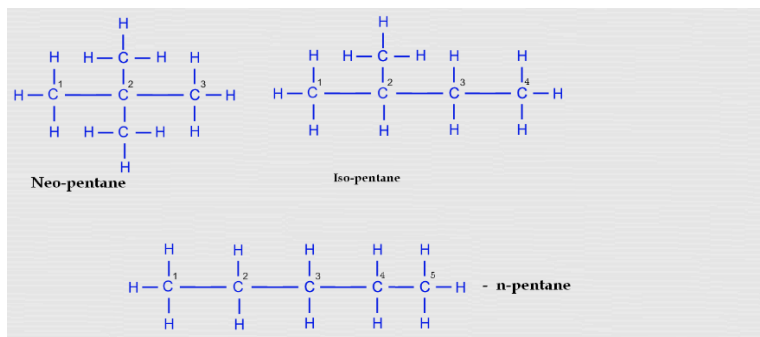
Isomers of butane, C₄H₁₀



Normal butane



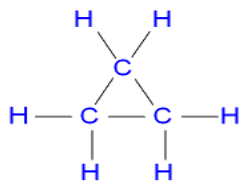
Isomers of pentane C₅H₁₂



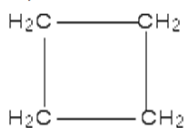
CYCLIC HYDROCARBONS

Hydrocarbons in which the carbon atoms are arranged in the form of a ring are called cyclic hydrocarbons.

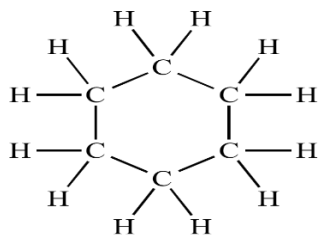
- Cyclic hydrocarbons may be saturated or unsaturated.
- Examples for saturated cyclic hydrocarbons: -
 1. Cyclopropane



2. Cyclobutane



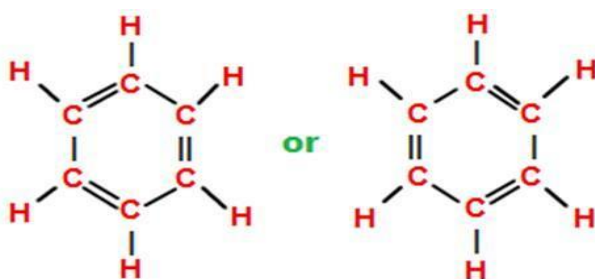
3. Cyclohexane



Example for unsaturated cyclic hydrocarbon:-

Benzene- C₆H₆

- Benzene contains alternate single and double bonds.



Formulae and structures of saturated compounds of carbon and hydrogen

No. of C atoms	Name	Formula	Structure
1	Methane	CH ₄	<pre> H H-C-H H </pre>
2	Ethane	C ₂ H ₆	<pre> H H H-C-C-H H H </pre>
3	Propane	C ₃ H ₈	<pre> H H H H-C-C-C-H H H H </pre>
4	Butane	C ₄ H ₁₀	<pre> H H H H H-C-C-C-C-H H H H H </pre>
5	Pentane	C ₅ H ₁₂	<pre> H H H H H H-C-C-C-C-C-H H H H H H </pre>
6	Hexane	C ₆ H ₁₄	<pre> H H H H H H H-C-C-C-C-C-C-H H H H H H H </pre>

HOMOLOGOUS SERIES

Homologous series is a group of organic compounds having similar structures and similar chemical properties in which the successive compounds differ by CH₂ unit.

Characteristics of homologous series

- All members can be represented by the same general formula.
- Adjacent members differ by CH₂ unit.
- Adjacent members differ by a molecular mass of 14 u
- Show a gradual change in physical properties (chemical properties are same)

Examples of homologous series

1. Alkanes
(General formula- C_nH_{2n+2})

Eg:- CH₄, C₂H₆, C₃H₈

ALKANE	CARBON NUMBER	FORMULA	STRUCTURE
METHANE	1	CH ₄	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$
ETHANE	2	C ₂ H ₆	$\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array}$
PROPANE	3	C ₃ H ₈	$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array}$
BUTANE	4	C ₄ H ₁₀	$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array}$
PENTANE	5	C ₅ H ₁₂	$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array}$

2. Alkenes

General formula-(C_nH_{2n})

Eg:- C₂H₄, C₃H₆, C₄H₈

ALKENE	No. of Carbons	Structure	Formula
Ethene	2	CH ₂ =CH ₂	C ₂ H ₄
Propene	3	CH ₃ -CH=CH ₂	C ₃ H ₆
Butene	4	CH ₃ -CH ₂ -CH=CH ₂	C ₄ H ₈
Pentene	5	CH ₃ -CH ₂ -CH ₂ -CH=CH ₂	C ₅ H ₁₀

3. Alkynes

General formula- (C_nH_{2n-2})

C₂H₂, C₃H₄, C₄H₆

ALKYNE	No. of Carbons	Structure	Formula
Ethyne	2	HC≡CH	C ₂ H ₂
Propyne	3	CH ₃ -C≡CH	C ₃ H ₄
Butyne	4	CH ₃ -H ₂ C-C≡CH	C ₄ H ₆
Pentyne	5	CH ₃ -CH ₂ -CH ₂ -C≡CH	C ₅ H ₈

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